



Trans-Lake Washington Project

Highway Alternatives Modal Evaluation Initial Findings

Prepared for

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1. SUMMARY OF EVALUATION

1.1 PURPOSE OF THE HIGHWAY MODAL EVALUATION

This report reviews the preliminary transportation, environmental and cost evaluation findings for highway alternatives being considered by the Trans-Lake Washington Project. This is part of the project's second level screening of alternatives (see Figure 1-1.) The goals for the modal evaluation are to:

- Identify major design, environmental, operating and cost characteristics for the SR 520 highway alternatives selected in the project's first level screening in October 2000.
- Assist in defining multimodal alternatives combining the most promising highway, high capacity transit and transportation demand management modal elements.
- Provide information for more detailed engineering tasks; these tasks will focus on options that increase transportation effectiveness, avoid or minimize the risk of environmental impact, and increase cost-effectiveness potential.

This initial findings paper highlights the early transportation, effectiveness and cost criteria information that showed substantial differences between the alternatives. A complete modal evaluation report will be provided to the project committees prior to the April meetings. That report will provide more extensive discussions of a wider range of criteria. The final report will also include detailed technical appendices covering analytical methods, data sources and findings by subarea.

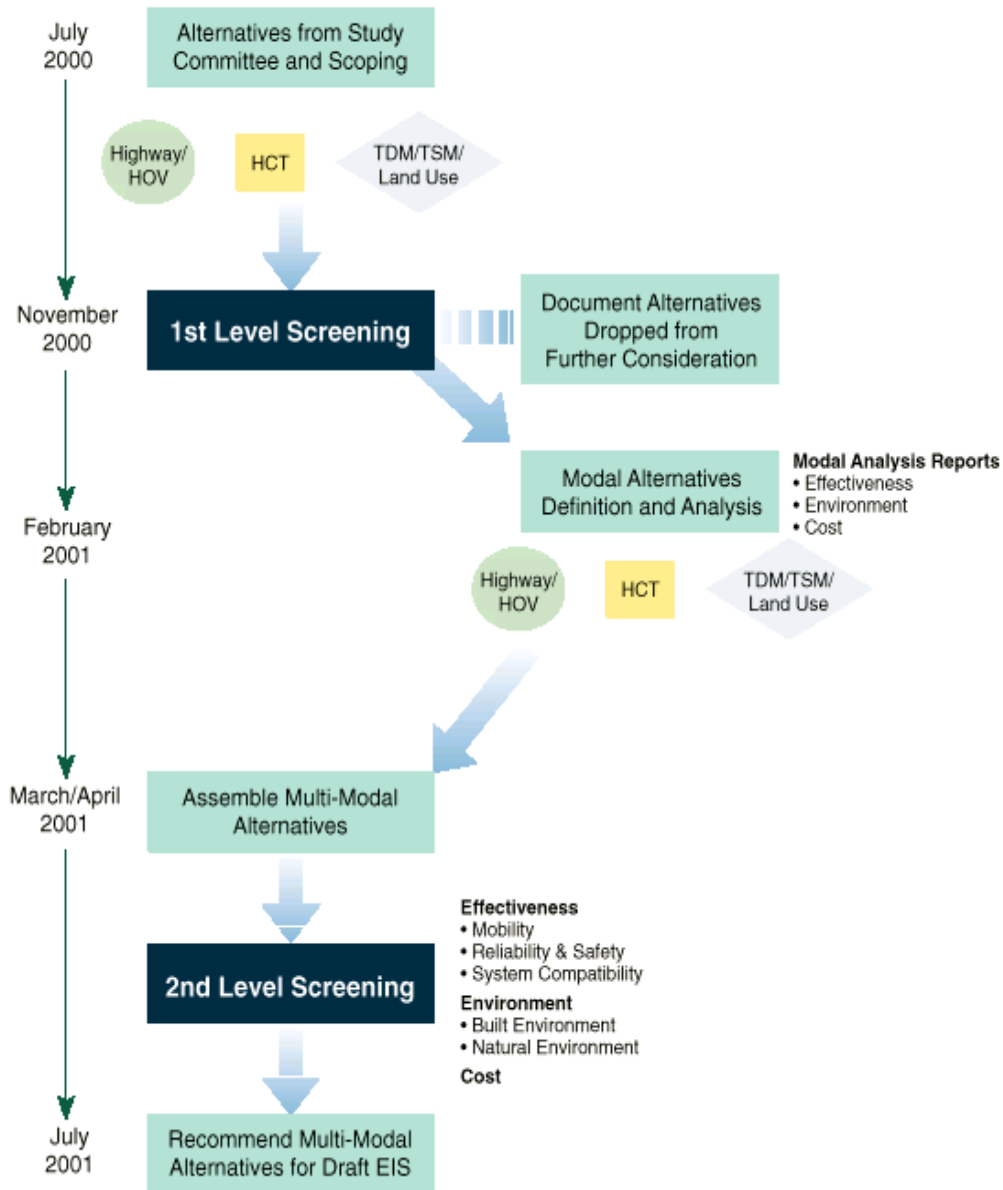
1.2 ALTERNATIVES EVALUATED

The project team developed initial engineering definitions of the highway alternatives to allow transportation forecasting, environmental review and cost estimating for the modal analysis.¹ Key features of the alternatives as evaluated are provided below.

¹ A Preliminary Detailed Definition of Highway Alternatives Report was prepared in February 2001. The report includes segment level mapping of improvements and a narrative description of alternative features and analysis assumptions. The report is available for review at the Office of Urban Mobility or at the Trans-Lake Washington Project Offices.



Figure 1-1 Alternatives Evaluation and Screening Process



Alternative B-1: Minimum Footprint

SR 520 remains a 4-lane freeway facility, but assumes the floating bridge would be replaced, and structures at Portage Bay and fixed spans approaching lake would require seismic upgrades. Westbound SR 520 between I-405 and the lake would be widened to improve HOV lane operations, and HOV direct access options will be considered at I-5 and I-405. Sections with shoulders and refuges would be provided, but they would not be continuous. Bicycle/pedestrian paths would be provided the length of the corridor, including the bridge.



Alternative B-2: HOV Lanes

SR 520 would be a 6-lane freeway facility with an HOV lane each way. The west end terminus options used for forecasting were (1) a direct HOV connection to I-5 express lanes south of SR 520, (2) removing the HOV restriction after Montlake, with two lanes to I-5 southbound and one lane to I-5 northbound. On the east terminus, HOV lanes would terminate at SR 202. Full HOV connections would be provided at the I-405 I/C, and direct access ramps would be provided at the S. Kirkland park-and-ride and the Overlake/NE 40th St park-and-ride. Bicycle and pedestrian path connections would be provided the length of the corridor. Transit service levels would increase by 50% over today.

Alternative B-3: HOV and General Purpose Lanes

SR 520 would be an 8-lane freeway facility with 3 GP lanes and one HOV lane each way. The HOV lane connections/termini options would be the same as B-2. The general purpose lane connection/terminus options used for forecasting were (1) to Montlake, or (2) to the Fairview Eastlake area. The eastern general purpose lane terminus would be at SR 202. Transit service and bicycle/pedestrian path features would be the same as B-2.

Alternative B-5: Bus and Vanpool Only Lanes

SR 520 would be a 6-lane freeway facility with one lane each way restricted to bus and vanpool use. All other features would be the same as B-2.

1.3 SUMMARY OF TRANSPORTATION FINDINGS

The Puget Sound Regional Council's regional forecasting model was used to predict the future transportation benefits and impacts of the highway alternatives. A 2020 Baseline was established to allow comparison of the effects of the alternatives against a transportation system with no major improvements to the SR-520 Corridor.

Several criteria showed substantial differences between the alternatives. The primary differences were in daily traffic volumes and total daily person trips. These values were provided for SR 520 and for all Trans-Lake trips (I-90, SR-520, and SR522), and by travel mode (general purpose trips, and HOV/transit combined trips). Travel time also provided a point of comparison among alternatives. Regional measures such as daily vehicle miles traveled or hours traveled did not tend to show large differences among the alternatives.

Some of the more detailed criteria were more difficult to readily apply at this stage without further analysis and refinement of forecasts. These criteria included peak period volumes (including mode split), congestion, and queue lengths. Although these criteria were still considered to compare the alternatives, the team used a combination of quantitative and qualitative methods to estimate effects. Of these criteria, congestion was the most useful in identifying differences among alternatives and design options.



Table 1-1. Mobility Criteria Results²
Year 2020 Daily Traffic Volumes and Person Trips (at a Trans-Lake screenline*)

	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1 /Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL LANES
Daily Traffic Volumes in 2020					
SR 520	121,200	121,200*	130,900/ 130,500	177,800/ 185,100	120,600
All Trans-Lake	362,800	362,800*	368,900/ 368,900	412,500/ 419,800	363,600
Daily Person Trips SR 520 in 2020					
General Purpose Trips	115,500	115,500*	119,000/ 119,100	167,200/ 174,500	116,200
HOV & Transit Trips	38,400	38,400*	87,600/ 86,000	95,300/ 96,200	51,200
All Person Trips	153,900	153,900*	206,600/ 205,100	262,500/ 270,700	167,400
Daily Person Trips: All Trans-Lake	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL LANES
General Purpose Trips	365,100*	365,100*	369,000/ 369,100	413,500/ 420,900	366,500
HOV & Transit Trips	92,500*	92,500*	126,700/ 126,600	137,000/ 138,100	112,800
All Person Trips	457,600*	457,600*	495,700/ 495,700	550,500/ 559,000	479,300
Average Travel Time (PM Peak) Using All Trans-Lake Corridors					
Downtown Seattle to Bellevue	32 min (GP) 25 min (HOV)	NA	32 min (GP) 24 min (HOV)	32 min (GP) 24 min (HOV)	33 min (GP) 25 min (Bus/Vanpool)
Downtown Seattle to Redmond	45 min (GP) 35 min (HOV)	NA	45 min (GP) 28 min / 29 min (HOV)	41 min (GP) 28 min (HOV)	45 min (GP) 37 min (Bus/Vanpool)
Downtown Seattle to Kirkland	37 min (GP) 30 min (HOV)	NA	37 min (GP) 27 min / 26 min (HOV)	36 min (GP) 26 min (HOV)	37 min (GP) 30 min (Bus/Vanpool)

² The initial transportation forecasts that form the basis of mobility measures for the highway modal evaluation should be considered preliminary. Forecasts are expected to change in the multimodal evaluations as the alternatives are further defined. Later forecasts will also incorporate additional model refinements, and the values will undergo additional processing to reflect a wider range of highway, transit and HOV operating factors.

* Alternative B1: Minimum Footprint assumes the same daily forecast values as a 2020 Baseline because no additional daily lane capacity would be provided. Some safety and reliability benefits during peak periods would be expected with Alternative B1 improvements, but they would not be likely to significantly change the daily forecast values.

♦ The Trans-Lake screenline is a north/south line that bi-sects the SR-522, SR-520, and I-90 corridors.

HOVs represent autos with 3 or more occupants. Non-HOVs are vehicles with a driver and up to one passenger.



Congestion Reduction. General purpose lanes on SR 520 would be congested at peak periods for the 2020 Baseline and for all alternatives. To identify the potential for congestion reduction, the analysis focused on the length of time that SR 520 would be congested, and it considered how many people and vehicles would be served.

- Alternative B1 (Minimum Footprint) and B5 (Bus/Vanpool Only) would have the highest levels of congestion, with stop-and-go conditions occurring the longest during peak periods.
- Alternative B5 would worsen conditions compared to a 2020 Baseline on the east side of Lake Washington because existing HOV facilities would be restricted to vanpool and transit use only. Not all the displaced HOV traffic would convert to transit or vanpool, causing volumes and congestion in the general purpose lanes to increase.
- Alternatives B2 (HOV Lanes) and B3 (HOV and GP Lanes) would have lower congestion levels compared to a 2020 Baseline. Peak hour traffic would still be stop-and-go in many locations, but congestion periods would be shorter, and substantially more people and vehicles would be served.
- For Alternative B3 (HOV and GP Lanes), Option 2 (Montlake connection) would worsen congestion between I-5 and Montlake. Option 2 (Fairview/Eastlake connection) showed a higher potential to reduce congestion.

1.4 SUMMARY OF ENVIRONMENTAL FINDINGS

1.4.1 Environmental Impacts

Below is a discussion about the relative differences in environmental impacts potentially caused by each of the four highway alternatives. Although the alternatives have been analyzed using all the environmental criteria agreed to for screening, this summary focuses on the criteria that both differentiate the alternatives and would reflect a considerable risk to permitting if avoidance techniques are not used in the next phase of design.

The federal laws which are of particular concern are Section 4(f) of the Department of Transportation Act of 1966, Section 106 of the National Historic Preservation Act, the Endangered Species Act, and Section 404 of the Clean Water Act. Under Section 4(f), transportation projects that adversely affect park and recreational lands, wildlife and waterfowl refuges, and historic sites cannot be approved by the Secretary of Transportation unless a determination is made that there is no feasible and prudent alternative, and that all possible planning has been done to minimize harm. Section 106 protects significant historic, archeological, cultural and tribal resources. Tribal resources include fish and shellfish in designated tribal usual and accustomed fishing areas. The Endangered Species Act and the 4(d) rule for chinook salmon make it illegal to “take” a fish listed as threatened; take includes adversely impacting fish habitat. Section 404 of the Clean Water Act requires a USCOE permit when locating a structure or fill materials in navigable waters. Table 1-2 provides summary ratings for the alternatives using the above three criteria.



**Table 1-2. Summary of Key Environmental Impacts by Alternative
(Number of Resources Potentially Affected)**

Alternative	Parks and Trails Section 4(f)	Historic Properties Section 4(f) and Section 106	Fish-bearing Streams and Wetlands ESA and Section 404
Alternative B-1: Minimum Footprint	3	0	1
Alternative B-2: HOV Lanes	4	1	4
Alternative B-3: HOV Lanes and General Purpose Lanes	5	3	4
Alternative B-5: Bus and Vanpool Lanes Only	4	1	4

SR 520 Highway Alternatives

Alternative B-1: Minimum Footprint would directly impact three parks (McCurdy Park, Washington Park and Arboretum, and Fairweather Park), raising Section 4(f) issues. Design modifications and alternatives refinement could likely either avoid or minimize impacts to some of the parklands. Of particular concern is the Montlake area, where the Washington Park and Arboretum surrounds SR 520, making it impossible to avoid impacts to that park. Foster Island/Montlake Cut habitat and wetlands would be impacted by this alternative. This area is a priority habitat for threatened and endangered species (bald eagle and chinook salmon). Construction activities could have impacts to juvenile salmon holding or traveling in shallow water. There may be opportunities to reduce impacts by shifting the alignment, but some impacts would be unavoidable and would require mitigation. Since the alternative would not provide significant traffic congestion relief, adjacent neighborhoods would be impacted by cut-through traffic.

Alternative B-2: HOV Lanes would directly impact four parks (the three identified for Alternative B-1 plus East Montlake Park), raising Section 4(f) issues. One historic property, Seward School in Eastlake, could potentially be impacted. It is likely that design modifications and alternatives refinement could avoid the impact. However, if impacts to the historic property could not be avoided, Section 106 and Section 4(f) issues would be raised. Four fish-bearing streams and wetlands would be impacted: Foster Island/Montlake cut habitat and wetlands, Kelsey Creek, Sammamish River, and Bear Creek. One of the interchange options at Montlake Boulevard/Lake Washington Boulevard includes a tunnel under Union Bay. The eastern portal would be located on Foster Island and a cut and cover tunnel would be constructed to the intersection of Pacific Street and Montlake. The in-water construction would cause disturbance to fish as they pass to and from Puget Sound, probably a fatal flaw for this interchange option.

Since the alternative would provide for more capacity than Minimum Footprint, noise levels would be increased for residents along the corridor. Mitigation in the form of noise barriers and depressed and lidded roadways would reduce the level of noise impacts.



Alternative B-3: HOV and General Purpose Lanes would directly impact five parks (the four identified under Alternative B-2, plus Bagley Viewpoint), raising Section 4(f) issues. Three historic properties (Seward School in Eastlake, Lake Union Steam Plant and Hydro House [Zymogenetics], and an historic property at the northeast end of the Montlake cut) could be impacted by the alternative. It is likely that design modifications and alternatives refinement could avoid the impacts. However, if impacts to the historic property could not be avoided, Section 106 and Section 4(f) issues would be raised. The same four fish-bearing streams and wetlands impacted under Alternative B-2 would be impacted under Alternative B-3, but to a greater extent. As in Alternative B-2, one of the interchange options at Montlake Boulevard/Lake Washington Boulevard includes a tunnel under Union Bay. The eastern portal would be located on Foster Island and a cut and cover tunnel would be constructed to the intersection of Pacific Street and Montlake. The in-water construction would cause disturbance to fish as they pass to and from Puget Sound, probably a fatal flaw for this interchange option.

This alternative would also have the greatest noise impacts due primarily to the larger capacity and wider footprint of the roadway. Mitigation may be more difficult to implement due to the wider footprint and the higher potential for noise to be diffracted over the tops of potential noise barriers.

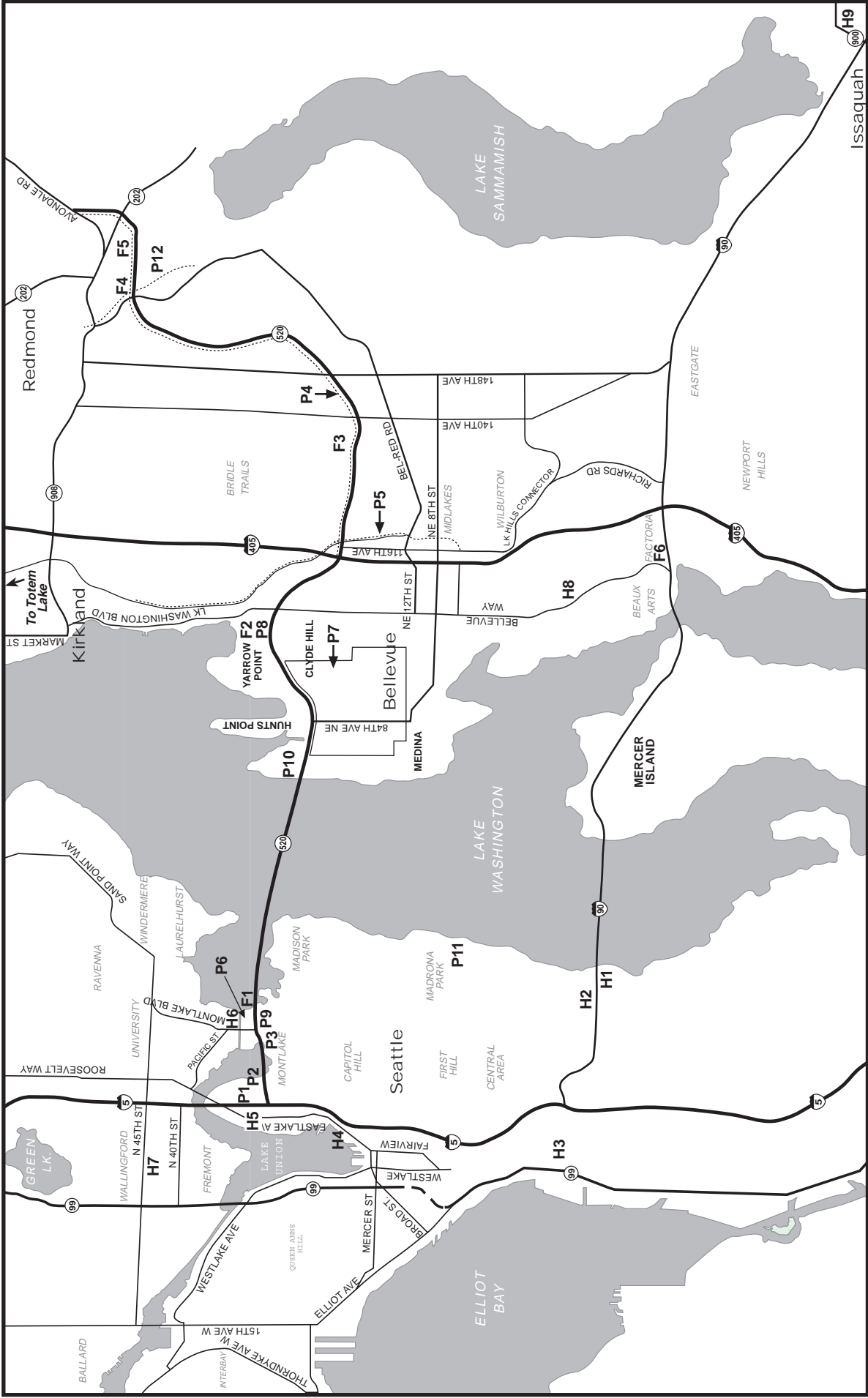
Alternative B-5: Bus and Vanpool Lanes Only would have the same footprint as Alternative B-2, and therefore impacts would be similar.

Comparison of Highway Alternatives

The comparison is relatively simple at this stage – the larger the footprint, the more environmental impacts there are. Minimum footprint would therefore have the least impact relatively, and the eight-lane alternative has the most impacts. However, all of the alternatives would involve substantial impacts because they would require reconstruction of all bridge structures as well as construction on other segments of the corridor.

Figure 1-2 shows the locations of these resources.





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Fish-bearing streams and natural resources potentially affected, raising ESA or permitting issues:

- F1 - Foster Island/Montlake Cut Area
- F2 - Yarrow Bay Wetlands
- F3 - Kelsey Creek
- F4 - Sammamish River
- F5 - Bear Creek
- F6 - Mercer Slough

Historic properties with potential Section 106 and 4(f) issues:

- H1 - Mt. Baker Tunnel
- H2 - Historic property near Mt. Baker Tunnel
- H3 - Seattle Chinatown Historical District (National Register), International Special Review District
- H4 - Lake Union Steam Plant and Hydro House (Seattle Landmark)
- H7 - Historic property near station at 45th Street N in Wallingford
- H8 - Frederick W. Winters House (National Register)
- H9 - Pickering Farm (National Register)

Parks and trails potentially affected, raising 4(f) issues:

- P1 - 10th and Roanoke Park
- P2 - Bagley Viewpoint
- P3 - Washington Park and Arboretum
- P4 - SR 520 Trail
- P5 - Proposed BNR Trail
- P5 - Proposed BNR Trail (Cities of Bellevue and Kirkland)
- P6 - East Montlake Park
- P7 - Points Loop Trail
- P8 - Yarrow Bay Wetlands
- P11 - Madrona Park



**Figure 1-2
Environmental
Hot Spots**

1.5 COST

The cost opinions provided in this report reflect a wide range of assumptions based on the preliminary information developed to date. Through the scoping process of the project, significant changes to the SR 520 corridor have been suggested in every segment, including at every interchange. Current design standards have been assumed for improvements throughout the corridor. The costs for each of these changes has been included to develop an understanding of the total costs involved if all improvements were made for the full corridor. It is important to recognize that this is a corridor-level estimate developed for planning purposes. A cost-benefit analysis has not yet been conducted. As more information is developed, the costs versus benefits of suggested improvements can be tested. The results may indicate that some improvements do not warrant further development, and the costs of the overall alternative may be lowered. Similarly, the costs ranges could increase depending on the extent of other features such as lids, noise walls and other enhancement or mitigation measures, or if highway and transit facilities are combined in the corridor.

Table 1-3. General Planning Level Cost Opinions by Alternative

ALTERNATIVE B-1: MINIMUM FOOTPRINT GENERAL PLANNING LEVEL COST OPINION	
Roadway Improvements	
Retrofit and Widen Portage Bay Bridge	\$60,000,000
Montlake Interchange Improvements	\$50,000,000
Retrofit/Widen Approach Spans and New High Rise	\$260,000,000
New Floating Bridge, No Drawspan	\$430,000,000
Mainline Improvements through Eastside Communities	\$60,000,000
Subtotal: SR 520 Corridor (Rounded)	\$860,000,000
Local Street Improvements	
Total Cost	\$10,000,000
Tunnels and Specialty Items	
Total Cost (see detail sheet for cost breakdown)	\$80,000,000
Storm Water Mitigation	
Total Cost	\$120,000,000
Environmental Mitigation and Enhancement	
Total Cost	\$ -
Design Contingency @ 20%	\$210,000,000
Total: Alternative B-1 (Rounded)	\$1,280,000,000



Table 1-3. General Planning Level Cost Opinions by Alternative (continued)

ALTERNATIVE B-2: SIX LANE GENERAL PLANNING LEVEL COST OPINION	
Roadway Improvements	Option 1
Westside Mainline and New Portage Bay Bridge	\$200,000,000
I-5 Interchange Improvements: Layout F	\$140,000,000
Montlake Interchange Improvements: Layout E	\$100,000,000
New Floating Bridge Approach Spans	\$490,000,000
New Floating Bridge	\$640,000,000
Mainline Improvements through Eastside Communities	\$100,000,000
Bellevue Way Improvements: Layout B	\$60,000,000
Mainline Improvements East of I-405 to Redmond	\$30,000,000
New 120th Ave Connection	\$30,000,000
New NE 24th Street connection	\$20,000,000
New NE 31st Street HOV Connection	\$40,000,000
W. Lake Sammamish Parkway Improvements: Layout B	\$30,000,000
Redmond Way Interchange Improvements: Layout A	\$40,000,000
Subtotal: SR 520 Corridor (Rounded)	\$1,920,000,000
Local Street Improvements	
At 6% Roadway Improvement Cost	\$120,000,000
Tunnels and Specialty Items	
Total Cost (see detail sheet for cost breakdown)	\$140,000,000
Storm Water Mitigation	
Total Cost	\$380,000,000
Environmental Mitigation and Enhancement	
Total Cost	\$ -
Design Contingency @ 20%	\$490,000,000
Total: Alternative B-2 (Rounded)	\$3,050,000,000



Table 1-3. General Planning Level Cost Opinions by Alternative (continued)

ALTERNATIVE B-3: EIGHT LANE GENERAL PLANNING LEVEL COST OPINION	
Roadway Improvements	Option 2
Westside Mainline and New Portage Bay Bridge	\$240,000,000
I-5 Interchange Improvements: Layout D	\$130,000,000 *
Montlake Interchange Improvements: Layout F	\$190,000,000 *
New Floating Bridge Approach Spans	\$570,000,000
New Floating Bridge	\$710,000,000
Mainline Improvements through Eastside Communities	\$120,000,000
Bellevue Way Improvements: Layout B	\$70,000,000
New I-405 Interchange	\$780,000,000
Mainline Improvements East of I-405 to Redmond	\$100,000,000
New 120th Ave Connection	\$30,000,000 *
New NE 24th Street Connection	\$20,000,000 *
New NE 40th Street Connection	\$80,000,000 *
W. Lake Sammamish Parkway Improvements: Layout B	\$30,000,000 *
Roadway Improvements (continued)	Option 2
Redmond Way Interchange Improvements: Layout A	\$40,000,000
Subtotal: SR 520 Corridor (Rounded)	\$2,870,000,000
Local Street Improvements	
At 20% Roadway Improvement Cost	\$570,000,000
Tunnels and Specialty Items	
Total Cost (see detail sheet for cost breakdown)	\$1,030,000,000
Storm Water Mitigation	
Total Cost	\$680,000,000
Environmental Mitigation and Enhancement	
Total Cost	\$ -
Design Contingency @ 20%	\$920,000,000
Total: Alternative B-3 (Rounded)	\$6,070,000,000
Layout Options	
Layout A: Foster Island to Montlake	\$410,000,000
Layout B: Under Montlake Cut	\$210,000,000



Table 1-3. General Planning Level Cost Opinions by Alternative (continued)

ALTERNATIVE B-5: BUS AND VANPOOL ONLY LANE GENERAL PLANNING LEVEL COST OPINION	
Roadway Improvements	
Westside Mainline and New Portage Bay Bridge	\$200,000,000
I-5 Interchange Improvements: Layout F	\$140,000,000 *
Montlake Interchange Improvements: Layout E	\$100,000,000 *
New Floating Bridge Approach Spans	\$490,000,000
New Floating Bridge	\$640,000,000
Mainline Improvements through Eastside Communities	\$100,000,000
Bellevue Way Improvements: Layout B	\$60,000,000
Mainline Improvements East of I-405 to Redmond	\$30,000,000
New 120th Ave Connection	\$30,000,000 *
New NE 24th Street connection	\$20,000,000 *
New NE 31st Street HOV Connection	\$40,000,000
W. Lake Sammamish Parkway Improvements: Layout B	\$30,000,000 *
Redmond Way Interchange Improvements: Layout A	\$40,000,000
Subtotal: SR 520 Corridor (Rounded)	\$1,920,000,000
Local Street Improvements	
At 6% Roadway Improvement Cost	\$120,000,000
Tunnels and Specialty Items	
Total Cost (see detail sheet for cost breakdown)	\$140,000,000
Storm Water Mitigation	
Total Cost	\$380,000,000
Environmental Mitigation and Enhancement	
Total Cost	\$ -
Design Contingency @ 20%	\$490,000,000
Total: Alternative B-5 (Rounded)	\$3,050,000,000

1.6 RECOMMENDED HIGHWAY ALTERNATIVES FOR MULTIMODAL COMBINATIONS

The most promising alternatives for multimodal combinations appear to be:

Alternative B2: HOV Lanes

This alternative would provide a substantial increase in mobility over a 2020 Baseline. Transit, HOV and general purpose/freight mobility would receive benefits. The alternative had the 2nd highest person trips and vehicle trips of the alternatives examined, and among the lowest levels of congestion. Although environmental impacts would occur in several areas, the potential impacts are in the same range as other build alternatives. For the next stage of evaluation, the definition should assume Option 1, with the added HOV lane connecting to the



I-5 express lanes. On the east side, the added HOV lanes were extended from West Lake Sammamish Parkway to SR-202.

Alternative B3: HOV and GP Lanes

This alternative has the highest potential to improve mobility, and would serve the highest numbers of vehicles and people. However, environmental impacts and costs were also highest with this alternative. It had considerably more impacts east of I-405 than other alternatives.

For the next stage of evaluation, the definition would assume Option 2, the Fairview/Eastlake connection, because it resulted in higher benefits to vehicle and person trips and lower congestion compared to a Montlake connection. Based on a review of travel volumes by segment, the alternative could also improve its environmental performance by dropping 2 general purpose lanes at west Lake Sammamish. This would reduce impacts to the Bear Creek and Sammamish River areas.

1.7 ALTERNATIVES NOT RECOMMENDED FOR FURTHER EVALUATION

Alternative B1: Minimum Footprint

The environmental impacts and costs involved with this alternative are not offset by a substantial increase in mobility compared to a 2020 Baseline. Without mobility benefits, the alternative does not meet the project's purpose and need. The alternative does minimize incident delay and improves trip reliability to some degree; however, these benefits would not substantially improve the daily peak period congestion delay on SR-520 compared to a 2020 Baseline alternative.

Alternative B5: Bus and Vanpool Only Lane

Transportation performance (including person trips, traffic volumes and congestion) are substantially lower than for Alternative B2, which has similar costs and environmental performance. In some segments, Alternative B5 would worsen congestion compared to a 2020 Baseline. Although HCT results are not directly comparable in this evaluation, a higher level of benefits could be achieved by a Bus Rapid Transit alternative.

